VOL. XIV. No. 4. APRIL, 1904

The American

X-Ray Journal

A JOURNAL OF

Progressive Therapeutics

Electrical Science
X-Ray Photography
Electro Therapy
Radio Therapy
Photo Therapy
Thermo Therapy
Hydro Therapy
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Official Organ of The American Electro Medical Society

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PUBLISHED MONTHLY BY THE AMERICAN X-RAY PUBLISHING COMPANY.
55 State St., Masonic Temple 1207, Chicago, Ill.

Editor, T. PROCTOR HALL, A. M., Ph. D., M. D.
Managing Editor, H. PRESTON PRATT, M. D.

SUBSCRIPTION RATES—IN ADVANCE:

United States, Canada and Mexico	$3.00	Foreign Countries	$4.00
Single Copies	50	Single Copies	60

Contributions of Original articles and other matter relative to X-Radiance and Electrotherapy, of interest to the medical profession, are solicited from all parts of the world. Contributors will be furnished extra copies of the JOURNAL containing their articles at cost of publication.

Entered as Second-Class Matter, March 4, 1903, at the Postoffice at Chicago, Ill., under the Act of Congress of March 3, 1879.

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DR. SHELDON LEAVITT.

Vice-President Chicago Electro-Medical Society. Author of "Psycho-Therapy."

THE AMERICAN
X-RAY JOURNAL
Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. XIV. CHICAGO, APRIL, 1904. No. 4

Psycho-Therapy.

BY SHELDON LEAVITT, M. D., CHICAGO.

A mere cursory survey of facts must convince one that mental medicine has a rational foundation. When we look out upon life's experiences evidence is everywhere found that mind is the dominating force among men. The deeper we go in our study of human experience the clearer becomes this truth. One mind controls another. By potent reasoning, by luminous example, by persuasive eloquence, men are swayed in their opinions and their conduct. We are natural hero worshipers. We prostrate ourselves before those who have become conspicuous for courage, for wisdom, for goodness, and for skill, and murmur our adoration.

Not only does one mind come to dominate another, but it acquires a power over the physical energies of the universe. Man takes unseen forces and makes them drive his machinery, carry his messages, light his cities and warm his houses. The utilities that intelligence has been able to evoke fill us with astonishment; but the limit has not been reached.

Nor is the field of mental triumph limited to the outer world. Indeed, its most astounding conquests are hidden in the depths of man's own being. His greatest conquest is the conquest of self, and his great creation the creation of his own destiny.

The powerful effect of mental upon physical conditions is patent to the mere tyro. One can not study the varying phenomena of organic action without recognizing the destructive power of mental concepts and emotions. In a patient who is very ill mental shock is able to turn the balance against recovery. To see hope fade from the countenance may mean that we shall soon see the pallor of death stealing over it.

"It is quite true," says one, "that depressing emotions may kill, but that does not establish your thesis."

No, but if destructive thot can depress haman vitality, can not constructive thot elevate and sustain? It is a poor rule that will not work both ways. With reference now to both drugs and mental concepts it may be safely affirmed that if there are depressants there are likewise stimulants and tonics. In short, the time has come when we should no longer close our eyes to the truth that clinical experience with psychic remedies develops evidence of the same character as that adduced from the use of other remedies, and of equal weight. In fact, many of us have become convinced that much of the evidence that has been cited to prove the value of drugs justly belongs to the domain of psycho therapy.

This is a tempting theme for discussion, but we are liable to become bewildered if we go far into it without following a definite line of thot. Much of mod-

ern psychological thot is valueless, save as it awakens a taste for the esoteric, because it is put forth without logical coherence.

What is of superlative value to us in the direction of cure is to determine (1) whether the subjective mind can be influenced in a deliberate and systematic way by the objective, and (2) how such influence is best exerted. It will be perceived that the importance of this study lies in the fact that it is the subconscious mind that presides over the functions of organic life.

An eminent professor in one of our leading universities, in writing of the evidence warranting a belief in psycho therapy, says:

"On every hand we are invited to come and see, and any disposition to ignore the facts thus open to observation, while at the same time wholly condemning the beliefs in the name of which they are wrought, justly leads to a charge of prejudice and lack of scientific method. In fact, the evidence of most remarkable cases of healing under all these systems of belief is so abundant that I shall not hesitate to assume without argument that we are here dealing with one or more genuine healing agencies."

Disease is evinced by what we call symptoms. These symptoms are of two general varieties, objective and subjective, the latter being those that are felt and the former those that can be determined by means of physical exploration. We admit that a case can be symptomatically cured without essential change in the objective conditions. For example, a woman with a retroverted uterus may be relieved of all sense of discomfort without restoration of the organ to what we call a normal position. To her this amounts to a cure, since conditions that present no subjective evidence of abnormality are essentially normal. On the other hand, the same woman, with her uterus in a normal position, and everything else in a seemingly healthy condition, may still suffer pain. The natural forces may be unable to cast out a bullet which has become imbedded in the trunk of a tree, or even in the body of a man, and the pathologist may tell us that there exists an abnormal condition. But nature comes to the rescue, restoring the cellular disorder which resulted from the penetration, and the tree, or the man, continues his unimpeded movement of life forces as is evidenced in unmodified functional activity.

This dual manifestation of mind, as seen in conscious and unconscious action, while it defies comprehension, commands our respect. It must be that the mind makes the body, rather than the body the mind. It is the mind of the cell that determines cellular development; and the human body is but an aggregation of cells. Only when mistaken for the reality and idolized does the body become eccentric and tyrannical. Viewed as an external manifestation it grows beautiful and comes harmonious with the environment of its own plane.

In what manner the subconscious mind is influenced and its actions modified and directed are the very things about which we are learning something in these days of varied practice.

As one out of many of the psychic truths that have been developed I may mention the exceeding value to healthful mental and physical functioning of an active volition. "Be systematically ascetic or heroic in little unnecessary points," says Prof. William James. "Do every day or two something for no other reason than that you would rather *not* do it, so that when the hour of dire need draws nigh it may find you not unnerved and untrained to stand the test. Ascetism of

this sort is like the insurance which a man pays on his house and goods. The tax does him no good at the time, and possibly may never bring him a return. But if the fire does come, his having paid it will be his salvation from ruin. So with the man who has daily inured himself to habits of concentrated attention, energetic volition, and self-denial in unnecessary things. He will stand like a tower when everything rocks around him, and when his softer fellow mortals are winnowed like chaff in the blast."

I will mention one more demonstrated law given us by the new psychology, and that is the surpassing value of faith as a condition of cure. There must be faith on the part of both physician and patient. The man who attempts to cure his patient by means of remedies in which he has no faith makes poor work of his attempts. And the patient who comes to the doctor without faith usually bears away with him the same ailments with which he came, intensified, it may be, a hundred fold. How often have we been shorn of our power to heal by the perverse unbelief of the sufferer. Doubt and fear paralyze the efficiency of remedies that might otherwise assert their curative virtue.

That there are valuable means of cure resident in the psychic realm many of us are fully persuaded. We have dogmatically set limitations upon their efficiency by our hampering skepticism. We have not been willing to give them a fair opportunity to demonstrate their powers. But we are becoming more rational and liberal. We are approaching a state of toleration which is most encouraging. I wish we knew better how to utilize the esoteric forces; but we are slowly learning. Those who know the least about a subject are often the most voluble in their denunciation of what it stands for. There can be no rational objection to a tentative adoption of methods that the experience of others has commended, no matter how new and problematical their nature, provided, of course, that they be not hazardous in themselves and do not displace those that are known to be measurably helpful.

Let us set for our motto in the realm of mind and morals this rational sentiment: *In certis unitas; in dubiis libertas; in omnibus caritas.** It is safe to do so, and it is just.

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*In certainties unity; in doubtful things liberty; in everything charity.

Radium, a Name Only.

BY J. RUDIS-JICINSKY, A. M., M. D., M. E., CEDAR RAPIDS, IOWA.

Ever since the wonderful discovery of the kathode rays by Zenger in 1884, the Becquerel rays in uranium, the Roentgen rays with their penetrative power for skiagraphy and therapy in medicine and surgery, the dark rays found by Le Bon, canal beams, Leonard rays, and the N rays; the discovery of Strutt, who proved beyond a doubt that all the metals are ionizing the air, and the discovery by Ebert that the air in the ground is more capable of carrying electric charges than ordinary air; scientific men have tried to answer the puzzling question what these and similar rays really are. Theories upon theories have been given, and these with the discovery of radium by Professor and Madam Curie, and the work of Bemont, have had such wide-embracing consequences that today thru the epoch-making investigations of Thompson and others we are facing many new and startling problems.

What is radium? They say that the name is given to a new elementary substance recently discovered, as stated above, and that it has the peculiar property of continuously emitting radiations, some of which are of a similar character to the x-rays. The metal uranium, and pitch blende, the ore from which it is obtained in very minute quantities, has also properties very similar to those of radium, but in much less pronounced degree. The extraordinary properties of radium have given rise to much discussion as to the ultimate constitution of matter, and the old laws of chemistry, physics and physiology seemed to be shattered at once. But they are not dead, they are here yet, better understood with all the flood of light thrown on these broad regions of hitherto inexplicable phenomena.

It will be well perhaps to begin with electricity. What electricity is we simply do not know, but we do know what to do and how to do it to get the greatest and most useful amount of the same for our purposes. We have here the name for some kind of energy, an energy which thru the medium of ether gives us radiation, motion, heat, or a sensation caused by the action of ether-waves on the eye, namely light. We know that a certain energy must be imparted to the radiometer-vane by the sun. To the sense of touch it appears to be heat, in the eye it produces the sensation of light, and in certain substances it has the power to produce chemical changes. Those chemical changes under the radiation from the sun have been going on for years and years on our earth, and we know that what we receive from the sun, whether it affects the sense of touch or sight or produces chemical changes, is in reality some form of energy and is one and the same form whatever the effect.

There is a class of substances which during several hours' exposure to light waves absorb their energy without becoming hot, and in turn emit light waves which are quite perceptible. This property of shining in the dark after having been exposed to light we find in decayed wood or over swamps. There where the atoms are crumbling and decaying, the decay itself seems to give us under the influence of the sun some other energy, perhaps some other life.

Madame Sklodowiska-Curie found that the residue of pitch blende (certain remnants of silver ore from Jachymov, Bohemia), an oxide of uranium, after extracting the uranium, was four and one-half times as active as uranium. She

fused these residues with carbonate of soda, treated with acid, precipitated with sulfuretted hydrogen, and so on; the guiding principle being that while the chlorid of the substance was soluble, the sulfate was insoluble; and she received a light brown powder, which slightly darkens in hue as the radio-activity increases thru higher refinement, radium bromid. The whole process is most assuredly chemical.

Apart from the heat rays three distinct kinds of radiations are constantly evolved from radium, the alpha, beta and gamma rays. The gamma rays are analogous to x rays, the beta rays are less penetrating, and alpha rays have exceedingly slight penetrating power. Briefly, the projectiles from radium are material, heat and electricity; while x rays possess the shorter wave-lengths of electric discharges. Both are ultra-violet, at the end of the spectrum, with a slight deviation in the beam. Finsen's light, the electric light, is in the same category.

Now if we observe carefully a Crookes tube in the beginning of the action (as described in *American Medicine*, July 4, 1903), giving some x rays in the hemisphere proper, we will see the stream from the kathode of a light violet color and in the shape of a pencil bombarding the middle focal point on the platinum plate of the anode; then two peculiar lines of the same color will appear exactly at the division of the hemisphere of x ray activity and the dark hemisphere behind. In a few seconds, the apparatus giving a small amperage only, the violet color of the kathode rays will fill up the whole space of the hemisphere of the x ray proper, and these will appear in their beautiful yellow-green color at once, when there is enough electromotive force behind the tube. This shows that the speed and division of the particles and corpuscles in the kathode ray depend upon this electromotive force, and the number of corpuscles in the discharge depends upon the magnitude of the current going thru the tube. It is an electrochemical action pure and simple. There is some medium filling the space of the vacuum tube unoccupied by air, a medium by which motion can be communicated from one point to another. This medium has received the name of ether, as we know. Is it possible that thru the influence of this medium the kathode rays are changed into more powerful rays of x ray order when there is more force and energy behind? If that is the case, the larger amount of energy in the ground-air, more capable of carrying electric charges with all their dynamic and chemic actions from the simplest decay to another animal or vegetable life, is due to electrons, the basic material out of which all matter is formed. The electrons are positively charged with electricity, and are the smallest particles known to be so charged. They are defined as the center of convergent ether strains. Ether then is the fourth stage of matter. Now we say ether, because we do not know more than that an empty space can not communicate motion. It is an unavoidable assumption, such as we make about the x rays, N rays, radium, etc., to explain their peculiar behavior and actions.

We get the ultra-violet and violet rays from the sun, besides all the other rays of light. The force behind is not known to us. The force electricity we know that we have. Is it the same force which we get from the sun, or some part of it, which enters into chemical combinations, into all kinds of periodic disturbances in the ether, with most complex aggregations of components in different objects on the earth? Is light, are all the rays of light, the result of electrochemical action in a

vacuum around the world of ours, having all kinds of electrons between the poles, positively charged with electricity? Are we all probably but varied forms of ether? We know that the electrons move freely, and everything has a greater or smaller number of electrons about it; in other words, everything gives more or less light, and radium is the best illustration of it. Professor Sir William Ramsay has described experiments in which the emanations given out by radium appear to be transformed into the gas helium—again life and death with light and darkness.

One theory after another appears, all dealing with the unknown, and always with the same energy; at least an energy that is named today electricity, tomorrow ether, transformation, electrolysis, emanation or decomposition, matter in ultragaseous state, dissociation of the elements, etc., welded into a theory, which from the practical standpoint is a result of a certain chemical process bearing the name Radium, a name only.

X-Ray Photograph of Rubber Tube.

Dr. J. F. Smith reported at a meeting of the Chicago Medical Society an investigation of the permeability of rubber drainage tubes to x-rays. The late Professor Fenger suspected that a drainage tube had been lost in the abdominal cavity of a patient. Before reopening the wound experiments showed that a red rubber drainage tube gave a distinct shadow through the tissues of the body. A skiagram of the patient proved in this case the absence of the tube. Rubber containing vermilion (mercuric sulfid) casts a dense shadow. Rubber containing sulfid of antimony and compounds of lead or zinc cast shadows which are less dense. The shadow of pure gum is scarcely perceptible thru any thickness of tissue.

Therapeutic Uses of X-Rays.

In the *Virginia Medical Semi-Monthly*, November 13, 1903, Dr. E. G. Williams, Richmond, Va., reviews the history and technic of x-ray treatment and gives a number of cases. "In treating cases my object is to use a ray that will penetrate just beyond the diseased conditions." Idiosyncrasy is of small importance. The effects of the rays upon normal tissues he finds to be in close accord with theory, and the therapeutic effects can be depended upon to the extent indicated by theory. The indications for the use of x-rays are bactericidal, stimulative, destructive and anodyne. The bactericidal action is useful in parasitic diseases; the stimulating action in chronic conditions, alopecia, rosacea, etc.; the destructive action in those pathological growths in which the abnormal cells are of much lower vitality than the others; and the anodyne effect is marked in malignant growths and neuralgia.

He reports six cases of epithelioma cured; one case of carcinoma of the face cured and another doing well; one carcinoma of the ear nearly cured; a submaxillary carcinoma improving; one case of recurrent carcinoma of the breast nearly cured, and one died with numerous metastatic growths in liver, kidneys and other organs; one case of acne rosacea of nose, redness disappeared, but the dilated capillaries persist; two cases of psoriasis cured; lupus erythematosis on nose, cured; case of locomotor ataxia is very much improved.

Keloid Treated by X-Rays.

Dr. William M. Harsha reports in *Medical Journal*, of January, the marked reduction in size of a keloid growth behind the right ear in a man of eighteen.

Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X Ray and Electro Therapeutics.

Lesson 11—HIGH FREQUENCY CURRENTS.

The discharge from a Leyden jar is oscillatory when the resistance of the discharge circuit is small. The period of the oscillation varies under different conditions, one of which is the capacity of the jar. An electric charge is a strain of the atoms and the ether in and about the dieletric of the condenser, a twisting strain of the atoms of the glass of the Leyden jar, according to the vortex theory. When the capacity of the jar is small there is a relatively small number of atoms to be twisted, and the total amount of twist produced by a given force is small. The untwisting, which constitutes the electric discharge, takes place with great rapidity, and the time of each oscillatory wave is exceedingly short, perhaps one hundred-millionth of a second. Each wave of the series has less amplitude than the one before it, so that the whole series may be over in less than the millionth of a second. When the capacity of the Leyden jar is greater the untwisting occupies a much longer time, and the frequency of the oscillatory waves is proportionally less.

When two Leyden jars are used in connection with a coil or static machine one of them is charged negatively and the other positively. The connection of the outer coats of the two jars places them in similar positions in the same electric circuit so that both in the charge and in the discharge the oscillatory currents and these only traverse the conductor connecting the outer coats of the jars.

It is essential to bear in mind these first principles of electric currents, that they do not flow at all except in complete circuits, and that the total current in every cross section of a complete circuit is the same. The glass of the Leyden jars is a non-conductor, yet it forms in this case part of the conducting circuit. A non-conductor is a substance whose atoms can not rotate continuously under an electromotive force without tearing them apart from their fellows and thus destroying the substance. But all non-conductors are dielectrics, that is to say, they are capable of conveying the electric twist to some extent from atom to atom thru their substance. In other words, the atoms in a non-conductor can rotate a little way, the strain becoming greater with the increase of force, and may oscillate back and forth so as to become to a limited degree conductors of an alternating current. The circuit of a direct current must consist of conductors only, or of conductors and such dielectrics as become conductors under the given conditions. But the circuit of an alternating current is not necessarily so restricted.

The oscillatory current in that part of the circuit between the two Leyden jars is almost always used as the basis of the high frequency currents used for therapeutic purposes. In order to secure the best results each jar should have a condensing surface approaching one square foot in area, and the two jars should be tuned to the same capacity. The break in the primary current must be sharp and clean, and the primary current must be sufficient to charge the condensers promptly and completely.

The high frequency discharge of the jars is not directly available therapeutically, because to pass it thru the body means to put into the circuit so much resistance that the oscillations are prevented. The oscillations of a tuning fork may continue for several minutes in air, since the air offers so little resistance that the

energy of the oscillation is dissipated slowly, but if the resistance to the motions of the fork be increased, as by touching it with a feather, the motions die out rapidly, while if the resistance be still more increased by pressing a finger on the fork the oscillations are prevented entirely. Electric oscillations are affected in a similar way by an increased resistance in the circuit.

On this account the resistance of the Leyden jar circuit is kept small by making the conductors of relatively short and heavy wires, and the therapeutic currents are produced from these by one of the following methods:

The wire from the jars is made into a helix or a spiral, from each end of which comes a branch wire to the electrode. The two branch wires together with the body of the patient form a shunt or branch circuit, whose resistance is many thousands of times greater than the resistance of the helix or spiral. Consequently a steady current would pass almost entirely thru the helix, leaving nearly nothing for the shunt. But with a sudden impulse this is not the case. The self-induction of the coil retards the first impulse for the minute fraction of a second, and the full electromotive force of the discharge is available to send this impulse with its succeeding waves thru the shunt circuit, of which the patient forms a part. The main part of the current, however, coming an instant later, passes thru the coil, and its oscillations each have their tips sent into the shunt. These are sometimes known as d'Arsonval currents. Their properties seem to be quite different from those of ordinary currents. For example, the two electrodes may be held in the bare hands with scarcely any sensory evidence of a current, but when the electrodes are brot near together a series of strong and bright sparks appears in the air between them, and if the metallic electrodes are touched together they adhere quite strongly, owing possibly to the heat generated by the current at the point of contact by the heavy current then passing. Muscular contractions may be produced in any part of the body by placing the electrodes upon the surface in such positions that the resistance of the shunt circuit is small, even if the uninsulated electrodes are at the same time held in the hands. In such case more of the current passes thru the shunt and less thru the coil, while so long as the shunt resistance is high only the tips of the oscillating waves pass that way.

A second method of obtaining high frequency currents that are available for therapeutic uses consists in the use of a small inductorium for transforming the oscillations into others of the same period but of higher potential. For this purpose the wire from the jars is wound in a rather open helix, so as to avoid self-induction, and within this and insulated from it is placed a secondary helix of much finer wire with perhaps ten times the number of turns, not too closely wound. Each set of oscillations of the current in the primary wire of this transformer (which is usually known as a hyper-static) produces by induction a similar set in the finer secondary wire. The two helixes must be properly tuned so that their natural periods of oscillation are in harmony, and it is a curious fact that unless this tuning is perfect better currents are obtained by using only one terminal of the secondary than by using both, because the waves interfere and partly neutralize each other.

The principle of resonance is made use of as a third method of obtaining high frequency currents of high potential and great intensity. The Oudin resonator is a large helix of heavy copper wire, rather

heavier at the base than above, very openly wound so as to avoid self-induction. Thru a few of the heavier turns of this helix the impulses from the jars are passed. The upper part of the coil then becomes the seat of high frequency oscillations of much greater potential, or in other words it is the seat of oscillations of much greater amplitude, which are like the current from the hyper-static in seeming not to have a circuit but to come from one terminal only. These electric oscillations correspond to the oscillations of the tip of a fishing rod when the handle is held in the two hands and strongly shaken. When the shakes are properly timed to the length and elasticity of the rod its tip makes much larger vibrations with much swifter motions than those of the part held in the hands.

The Oudin resonator, when properly excited by a heavy current from a coil or static machine, is capable of giving a torrent of sparks or a blue spray (effluve) four to six inches in length. From a pair of resonators properly tuned a spray may be made to pass between two electrodes nearly a foot apart.

High frequency currents can not be measured satisfactorily with an ordinary meter. The dissipation of energy in a conductor is measured, but this rate increases with the frequency of the current. The current from a resonator may register 300 milliamperes or more and be perfectly harmless, while one third of that current actually passing thru the body would be dangerous to life. But so long as the frequency is the same the meter serves as a relative measure and is therefore of considerable service in giving treatments.

High Frequency Currents in Medicine.

In *The Medical Visitor* for December, Dr. E. H. Grubbe gives a popular exposition of this subject and makes, as is very frequent in popular papers, a few inaccurate statements, such as these: "Electric vibrations differ from other forms of vibration only in rate and number." "The simplest form of the electric vibration is the direct or continuous current." As a matter of fact, vibrations differ in kind as much as they do in frequency. A direct current is not a vibration at all. The words "direct" and "continuous" are not synonymous terms; a direct current is one which goes in one direction only; a continuous current is one that keeps on without interruption.

Action of Light on Germ Diseases.

The Electrical Review suggests the theory (Jan. 2, 1904) that the germs of diseases which are favorably affected by radiations may be of a size somewhere near the wave length of the ray which affects them, and that they are injured or destroyed by the electric currents set up in them when the tuning is accurate. Possibly the physician of the future will screen off all the other rays and use only those which are destructive to the germs of the disease which he is combating.

A New Alternating Current Rectifier and Interrupter.

BY W. B. CHURCHER, M. E.

CINCINNATI, OHIO.

The principles underlying the aluminum rectifier have recently undergone a process of development that makes this device a practical piece of apparatus. For the benefit of those unfamiliar with these fundamental principles the simplest type of rectifier will be first described. An aluminum rod when connected to the positive side of a source of direct current and immersed in a phosphate of soda solution with said solution in contact with another electrode, say of platinum, which is connected to the negative side of the same source of current simply, will develop upon its surface a film that almost completely insulates the aluminum from the

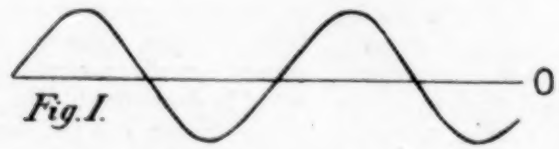


Fig. 1.

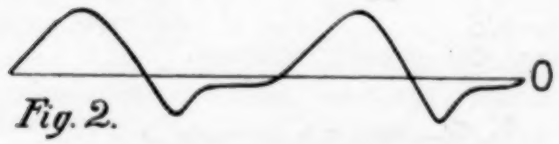


Fig. 2.

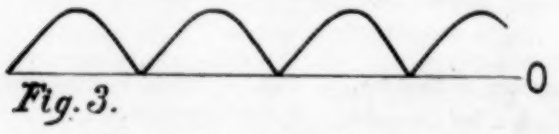


Fig. 3.

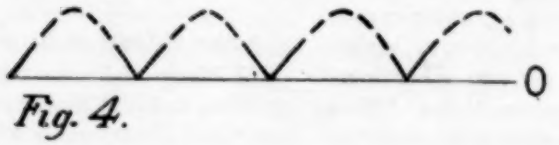


Fig. 4.

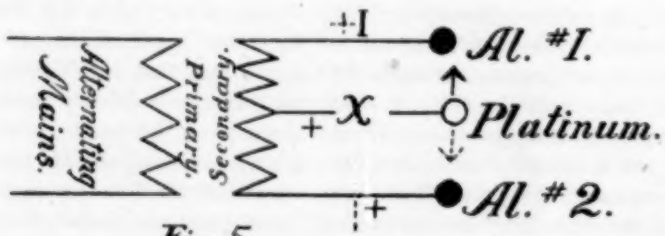
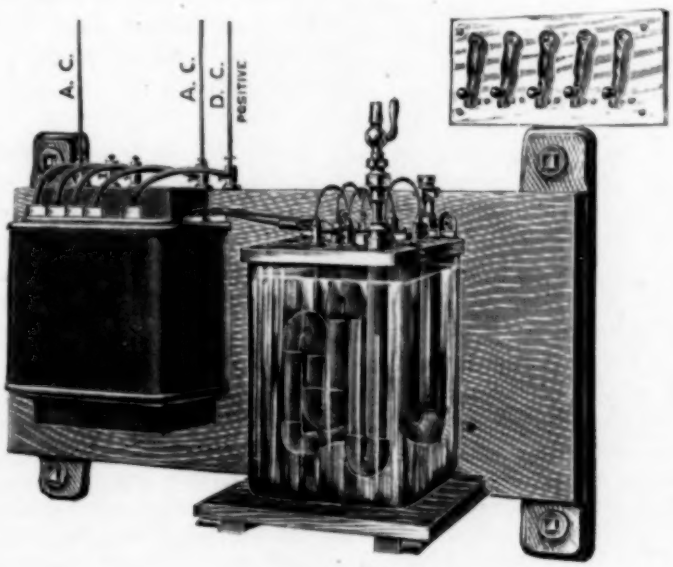


Fig. 5.

solution. When the current is reversed so that the aluminum is negative to the platinum the film permits the free passage of the current. If the current is again reversed the film at once insulates the aluminum from the solution. It appears to make little or no difference how rapidly these reversals of current take place, as the valve action of the aluminum remains unchanged. It will, therefore, be understood that an alternating current of any frequency will operate the "valve." At the instant the aluminum rod becomes positive a small momentary current does pass from the aluminum to the platinum thru the solution, but only during the actual closing of the "valve." Therefore a complete rectifying of the current can not take place when one aluminum electrode is used. Fig. 1 illustrates the ordinary alternating current wave and Fig. 2 illustrates the wave as produced by the simple rectifier as above described. The curve below the O line represents the current that "leaks" from the aluminum rod at the instant it becomes positive.

The Churcher Rectifier, which produces uni-directional current, is illustrated in Fig. 3. This is accomplished by the aid of two aluminum electrodes instead of one, both in the same solution with the platinum electrode. This method of rectifying requires the use of a transformer having a center tap in the secondary winding (Fig. 5). The two extreme terminals of this secondary are connected to the two aluminum electrodes in the rectifier solution (Fig. 5). It will be readily seen that when No. 1 aluminum electrode is positive No. 2 aluminum electrode is negative. When reversal takes place No. 2 electrode becomes positive and No. 1 negative, etc., etc. When No. 1 electrode is positive its film insulates it



from the solution so that the half of the transformer connected to it can not act. No. 2 aluminum electrode being negative, current passes from the center tap of transformer to the platinum and thence thru the solution to aluminum electrode No. 2. At reversal of the current the reverse action takes place, so that the center tap of the transformer is positive at all times to one or the other of the aluminum electrodes producing a current as in Fig. 3. The apparatus (X) to be operated by the uni-directional current is to be connected in circuit between the center tap of the transformer and the platinum electrode. The leakage of current before mentioned still takes place, but passes to the negative aluminum electrode instead of to the platinum electrode and hence does not affect the apparatus at (X).

The primary windihg of the transformer can be readily adapted to any alternating current line and the secondary can be wound to deliver any voltage or amperage of direct current. The regulation of the direct current from the rectifier is best attained by regulating the primary alternating supply by means of inductance or resistance.

The Churcher Alternating Current Rectifying Interrupter is constructed upon the principle above described, but has restricted area of platinum electrode exposed to the solution. If an x-ray coil is used, comparatively few primary turns of low resistance be connected in circuit at "X" a sufficient volume of current will flow to completely interrupt the current at the platinum electrode. There may be a number of these electrodes of different areas so that by the selection of any one or any combination of two or more a wide range in volume of spark and rapidity of interruption may be obtained. This interrupted current always flowing in one direction produces results in the x-ray tube similar to those produced when ordinary direct current is used. In fact, the results are superior to the extent that the interruptions can not take place as rapidly because of the wave form of the direct current. The interruptions can take place only during or near the peak of the pulsating (not alternating) wave from the rectifier, or approximately with one-half the frequency when direct current is used. Fig. 4 approximately illustrates the interruptions from this type of alternating current interrupter. Fig. 6 illustrates the complete rectifying interrupter.

Light Rays for Tuberculosis.

Dr. C. E. Rogers, in the *St. Louis Medical Arena* for December, says the germ-destroying power of light is not directly dependent upon its quality, but upon the quantity. The quality is only important as a factor in reaching the diseased parts. He finds the combined rays much more penetrating than the violet or ultra violet. Recovery from pulmonary tuberculosis is possible even in advanced conditions. It depends as much upon the general condition of the patient as upon local treatment. The exposures to light must continue at least an hour at a time, and sometimes a period of ten or twelve hours is required for a single treatment. His results have been good. The shortest period of treatment followed by cure was one month, the longest six months, the average ninety-eight days.

A Study of Light—Ultra Violet Light.

BY J. MOUNT BLEYER, M. D., F. R. A. M. S., LL. D., OF NEW YORK CITY.

(*Continued from page 32, January, 1904.*)

The fluorescence spectrum received upon the fluid shows, as I have already mentioned, three regions of stronged fluorescence, and the absorption spectrum of naphthaline, which by placing a small cell filled with the solution in front of the slit may be obtained upon a paper screen, gives a key to the cause of this phenomenon. In this spectrum (see p. 25) a completely black band is visible in the green-yellow band D, a dark band between E and b, while the violet end appears shaded. On employing a very small solution of the naphthaline coloring material the whole spectrum vanishes, with the exception of the red end, which remains apparent to a point behind C. If, now, the absorption spectrum be compared with that thrown upon the fluid, the intimate relations between the absorption and fluorescence, that has already been pointed out in the esculin solution, is corroborated in the minutest particulars, for every dark band in the absorption spectrum corresponds to a bright band in the fluorescing spectrum. Every ray absorbed by the fluid occasions fluorescence, and the fluorescent light produced is the brighter the more completely the ray is absorbed.

A second example of the excitation of fluorescence by rays of small refrangibility is exhibited by the solution of chlorophyll. The spectrum projected upon this green fluid fluorescence of a dark red color from B to a point within the ultra-violet, exhibiting at the same time bright bands which correspond with the dark bands in the absorption spectrum between B and C, where the greatest amount of absorption occurs, the fluorescence is also the most marked; but it is the middle red rays which here act so powerfully as excitants. It is remarkable that the red fluorescent light which the chlorophyll solution emits likewise lies, in regard to its refrangibility, between B and C. Cholorphyll solution affords a proof that all rays of the spectrum, with the exception of the extreme red in front of B, are capable of calling forth fluorescence. Their capacity for doing so depends simply on the power of absorption of the fluorescing substance. The most refrangible violet and ultra-violet rays are, however, characterized by the circumstance that they are capable of exciting all known fluorescing bodies.

Fluorescent light is only perceived so long as the fluorescent substance is illuminated by the exciting rays; as soon as the light falling on it is obstructed, the colored shimmer vanishes. It is only in the case of some fluorescent solid substance, as, for example, fluor-spar and uranium glass, that, with the aid of appropriate apparatus (Becquerel's phosphoriscope) a very short continuance of the fluorescence may be observed to take place in the dark.

There are, however, a number of bodies which, after having self-luminosity excited, continue to shine for a certain time in the dark. These substances, and the physical cause, I have already alluded to in one of my published papers, to which I refer you.

I will devote the rest of this paper to demonstrating some of the photographic qualities of light waves.

I begin with a piece of common "printing-out" paper—in other words, paper that has already been covered with a sensitive film saturated with chlorid or bromid of silver that turns almost black after exposure to light for a certain time. I cover a portion of this sheet of sensitized

paper with stencil plates cut out in sheet zinc and then subject it to the white light proceeding from an electric arc lamp placed near by. In thirty seconds you can see on the already darkened paper where the light waves, falling on the exposed parts, have performed their chemical action and printed patterns of the stencils. And at this point arises the question—which, of all the rays, actinic, calorific and visible, that have been permitted to fall upon the paper, was the actual ray that produced the given result? We will prove this by a simple test, by turning on the light in the optical lantern and utilizing the quartz lenses and prism to produce the spectrum. We now stretch out a long piece of "printing-out" paper along the entire length of the visible spectrum to a distance into the invisible spectrum at both ends and leave it there to develop. In a few minutes I shall refer to it again.

I take another sheet of "printing-out" paper. Over it I place a sheet of opaque tinfoil, in which a number of holes have already been cut. These holes I cover with a number of thin pieces of different materials—for instance, 1, window glass; 2, flint glass; 3, red glass; 4, green glass; 5, blue glass; 6, quartz; 7, fluor spar; 8, rock salt; 9, ebonite. I now pass the sensitized paper so covered under the rays of an electric arc lamp, placed so as to throw all its light downward. Since the paper can be darkened only under those materials transparent to the photographic rays, it will naturally appear at once which materials cut off the active waves. Two minutes' subjection to the light will give the test.

You will see at the end of that time on taking up the sheet none of the photographic rays have been transmitted by the red glass or the ebonite (itself black); whereas the green glass has held back the greater part of them, while the flint glass has transmitted only a few; you will notice now that beneath the quartz, the rock salt, the blue glass and the window glass the paper appears to have darkened in about equal degrees—altho by applying a more powerful test we could find degrees of difference among even these. One practical fact at least has been proved by this test, that, altho red light affects our effect, it produces no effect whatever upon a photographic film. Every photographer shows that he has observed this by using red-colored tissue or red glass to screen the light he uses while preparing and developing his plates or to cover the windows of his "dark room."

I now return to the long strip of sensitized paper that has been during this time exposed to the spectrum. On examining it, it is apparent that it has preceptibly darkened at the violet end even beyond the end of the visible violet, and beyond even into the region where our plain eyesight can see nothing. In fact, the photographic spectrum lies, for the most part, beyond the violet, the most active waves being than those visible. Nevertheless, it is a fact that the rays of sensitiveness can be altered by the use of other chemical preparations. To Captain Abney science owes the discovery of emulsions of bromid of silver in films of gelatin, so prepared as to be sensitive not to violet or ultra-violet light alone, but to green and yellow as well and even to red waves.

Another very interesting experiment shows what chemical result light waves can produce is to induce mixed hydrogen and chlorin gases to combine. These gases (prepared by electrolysis of hydrochloric acid) may be kept mixed in glass bulbs for any period, if kept in the dark, and provided they are not chemically com-

bined. If subjected to the diffused light of a room, they combine slowly; if subjected to direct sunlight or to the light of an electric arc lamp or ultra-violet tube, they combine with great violence and explode the bulb. And here again comes the question—which part of the light is it that gives the results? Assuredly, not the red waves, since, if protected by red glass, these bulbs of mixed gases may be freely subjected to light. Therefore, the active ray in this case is the ultra-violet.

Take a thin glass bulb containing the mixed gases that has been carefully kept in the dark. To avoid any accident, we place it into a lantern, into a nozzle of which we will direct, from the outside, the rays of an electric arc lamp, or ultra-violet tube. To direct away a great part of the ordinary rays, I first place between them a sheet of violet glass that allows of some violet and very few ultra-violet rays to pass. Then, interposing a quartz lens, I concentrate the ray upon the bulb, when—bang—it explodes, showing the marvelous activity of waves of this kind. If the ultra-violet vacuum tube is used an almost immediate explosion takes place, whether screens of glass are interposed or not.

It may possibly have occurred to you that if so marvelous a photographic activity belongs to waves that are invisible to the naked eye, it should be possible to photograph the invisible, and, in fact, it is.

About twenty years ago the veteran chemist, Dr. J. Hall Gladstone, lectured here on the photography of the invisible, demonstrating how he himself had been successful in photographing figures of things absolutely invisible to the human eye. The demonstration of this remarkable fact is very simple. I place against the wall a drawing board, over which I have placed a white sheet of cartridge paper, with the light of an arc lamp shining on it. Only a plain white surface can be seen. We will now photograph it. When developed, the photograph will prove that an inscription was written, which, altho not visible to you, was readily photographed by the camera.

The inscription was written on the sheet with colorless sulfate of quinin dissolved in a solution of citric acid. This substance fluoresces, and in the act of fluorescing destroys the ultra-violet light, which would otherwise be reflected from the paper so treated. The parts where the sulfate of quinin has been applied consequently come out on the photographs darker than the untouched surface of the paper.

Since photographic action has proved to us that even with the lack of every kind of apparent visible light it can still succeed in detecting these ultra-violet rays, it will be necessarily a factor in further researches into the qualities and properties of these invisible waves.

As wave length is one of the properties that has great bearing upon the subject with which I am dealing, I propose to refer to this in some detail. If we consider a wave of light in its simplest form, we imagine a disturbance consisting of a uniform succession of crests and hollows, and a luminous radiation will extend as an unbroken succession of such crests and hollows from the point of origin to the place where they are absorbed and converted into some other form of energy. These two points (crests and hollows) may be separated but a few inches in laboratory experiments, as I will show here in the form of spectrograms, or any number of millions of miles, in the case of light from a distant star. So we know

that a wave length is the distance measured from crest to crest, and is expressed in units of a scale of millionths of a millimeter.

I have already spoken of the different wave lengths of vibration, telling you how our sense of color depended upon them, the shorter waves producing what we call violet light, and the longer ones red, the intermediate giving blue, green, yellow and orange. Nevertheless, I repeat here, so as to be perfectly clear in regard to what I have to say: Radiations of this character are not confined to the limits of our vision, but extend beyond the red in a series of increasingly long waves, constituting what is called the infra red region, and beyond the violet in a series of increasingly short waves, constituting the important ultra-violet region, which is of present interest to us.

This diagram I present here will help to clear up the mistaken ideas in connection with ultra-violet rays and those more refrangible. Those rays that are in the visible region are between 435.8 and 759.3 units; below this latter limit evidence has been obtained by Prof. Langley of radiations with a wave length of over 5,300 units, and in the ultra-violet region the researches of Victor Shuman, of Leipsic, have resulted in the photographic record of waves as short as 120 units. Mr. Shuman's work on spectrum photography is well known and needs no introduction, as it is appreciated by all who have made of spectrum analysis a study.

More than twelve years ago he demonstrated the remarkable absorptive effect of air upon very short vibrations, so great, indeed, that even the air within the tubes of the spectograph was a serious obstacle to the investigation. We find that the very short waves do not reach us from the sun, being absorbed by the atmosphere; in fact, a few inches of air even will absorb them on the outside. I am, however, of the belief, from practical therapeutical tests and my large experience with light, that these ultra waves are of no value by themselves, so let us not worry over them and their scarcity of production. I am firmly convinced that from the mixed rays within the bounds of the scale from 500 to 300 our best therapeutical results will be gotten. These may even be found later on to vary, as we are still much in the dark as to the exact action of each, whether separate or combined.

Mr. Shuman, with all the obstacles that confronted him, however, was able with the apparatus then at hand to demonstrate the existence of lines up to and beyond the wave length 185 units, using the light of the aluminum spark.

Mr. Shuman's ingenuity, which has characterized all his work, has since constructed a spectograph exhausted of air, with lenses and prisms of white fluor spar. The source of light for these researches was the hydrogen Geissler tube. With the exhausted spectroscope, as it is termed, and photographic plates of ultra sensitive kind, he finds the photographic action of the spectrum beyond the wave length 185 very strong. Indeed, it is composed of fourteen lines, including altogether about 600 lines. The boundary of this hitherto entirely unknown portion of the spectrum extends about four times as far from the most refrangible line hitherto photographed (the aluminum line 185), as that line is beyond the blue hydrogen line of wave length 486. The interest of these researches is, therefore, very great, and it seems as tho the limit of the radiations might only be reached when we can detect them in the universal ether itself, unaffected by a trace of an absorptive

medium and with the photographic plates of ultra sensitiveness.

The regular photographic plates that we employ in usual work do not serve for this class of spectrum photography, but there are plates of which Mr. Shuman speaks, and used by himself, possessing peculiar sensitiveness to ultra-violet rays, but relatively very little to the light of the visible spectrum. Because of this insensitiveness to the visible spectrum, the plate acts toward the ultra-violet precisely like one exposed to filtered light, from which all the rays have been absorbed, which, as diffused light in the spectograph, would tend to cause fogginess of the picture. Such is the effect when an attempt is made to photograph the ultra-violet spectrum with an ordinary plate; for, before the ultra-violet rays have affected the plate, or produced a distinct image, the plate is fogged all over by the diffused lights. This, however, is not altogether true, as I have gotten the spectrum of the ultra-violet light on ordinary photographic plates without altogether producing fogging, tho not such a large spectrum as Mr. Shuman speaks of. I am fully in accord with his experiments from what my experience has taught me in spectrographing the ultra-violet rays.

I find that the vacuum ultra-violet tube (Mount Bleyer's) shows on its spectrogram a test that gives equal penetration thru glass as without it. Any screen of glass interposed between the spectroscope and the vacuum ultra-violet tube, while taking a spectroscopic photo of the ultra-violet light, will be found not to hinder the passage of the ultra-violet rays. Whereas, if the same process is again repeated in photographing the ultra-violet ray of an arc or electric spark of any kind in the open air, and any kind of a screen of glass, paper, paraffin paper or other such materials be interposed between the spark and the spectroscope, excepting quartz, the ultra-violet ray is cut out by such screens as here mentioned. However, we find that electric sparks give a large size ultra-violet ray spectrum on the photo, if taken without the interposition of any screens whatsoever.

It is worthy of note, according to the many hundreds of practical demonstrations that I have made, photographically as well as otherwise, that the sparks lack the penetrative quality, but gain in quantity of light, as compared with the ultra-violet rays which are generated from a vacuum tube. These vacuum tube ultra-violet rays have more diffusion, less concentration and more penetration; while the electric sparks and arcs possess greater ultra-violet rays on account of their concentration, but lack penetration. All this is easily proven by spectroscopic photography and allied experiments.

SOME IMPORTANT FACTS ON LIGHT RAYS OF SMALLEST WAVE LENGTH.

For a long time wave lengths of two lines of the aluminum spectrum were considered the shortest. According to the measurements made by A. Cornus, the length of these lines in Angstrom units (one A. = 0.0000001 millimeter) were 1,860 and 1,851 A. U.

It is absolutely impossible for the human eye to discern the lines or even the entire spectrum region of the ultra-violet. The privilege is reserved for very few to observe the ultra-violet through the ocular of a sufficiently transparent spectrum apparatus as plainly as the less deflected region of the visible spectrum, which, as we know, can be observed by any sound eye. The ultra-violet light can be made visible only in an indirect way—either by projection upon a fluorescent screen, or by

photographic fixation upon a sensitive plate.

The spectrum of fluorescence can be observed directly or through a lens; in either case it will lack definiteness and clearness.

Formerly when the photographic plate could be developed only by liquids and the present dry plate was unknown, the fluorescence spectrum was often used in experiments with ultra-violet rays. At present, with the advantages of the bromid of silver gelatin plate, no one would think of employing the imperfect fluorescence spectrum.

The photographic method of observing the ultra-violet light has replaced the directly ocular. Anyone who has used both will agree with the following statement: The fluorescence spectrum is much too crude and insufficient for modern exact spectroscopy.

The modern dry plate is found to be more sensitive to the ultra-violet rays, and this greater sensitiveness greatly promotes the exactness of spectrum investigations.

The same shows its greatest sensitiveness to all light sources of electric origin, not in the visible spectrum, but remote from this in the ultra-violet.

In photographing the spectrum of any metal spark, the ultra-violet is always the first to develop, and only after longer exposure will the visible spectrum appear. But it is by no means the whole ultra-violet light that distances the visible. Only a part of it possesses this photographic superiority.

All the light that works efficiently beyond the cadmium line 24 requires for reproduction considerably longer exposure. The sensitiveness of the plate decreases visibly from this line (its wave length = 226.6) with the deflectibility of the rays, and with the employment of large photographic apparatus it sinks, at about 200 wave length to zero.

Approximately, therefore, 200 would be the smallest wave length that can be observed thru the usual large grating apparatus.

Experimenting at this limit of efficiency with a small photographic apparatus, the domain of observation becomes considerably extended and the usual bromid of silver gelatin proves—with sufficiently short focus and transparency of the optical body—serviceable down to 182 wave length.

This relative limit of smallest wave length was decided by thoro experiments in 1890 by Schuman, with an apparatus of 180 min. focus (Fraunhofer line D.).

The fact that the spectrum of photographic efficiency runs the farther into the ultra-violet the shorter the focus, shows plainly that the limit of photographic efficiency is connected with the density of the air stratum that the rays must traverse on their way to the photographic plate.

If we, starting from this fact, try to further decrease the air strata, we shall observe that the photographic efficiency recedes still a few lines of smaller wave length, yet the increase in length of the efficiency strip is so insignificant as to be out of proportion with the labor and expenditure for such a small spectrograph.

It therefore seems that in this the true limit of perceptible rays of smallest wave length is reached.

In this we are confirmed by the fact that the fluorescence-spectrum disappears much sooner, at wave length 185, and that it is therefore useless for the observation of all more widely deflected rays.

If we did not have at our disposal the photographic plate, but only the fluorescent materials, the smallest perceptible light wave would be 185.2.

We see from this that both extreme values are true only proportionately or relatively.

Similar to the fluorescent substance, that ceases to light from wave length 185, possibly the photographic plate might be incapable of receiving impression possible of development of all rays with wave length below 182.

This reflection guided Shuman when he was not successful in making extensive experiments two years before with rays of the most deflexible ultra-violet.

He found that it was only lack of sensitiveness of the plate employed, and by no means the insufficient energy of the light rays, that stood in the way of satisfactory results beyond 182.

He furthermore found that the rays were "choked" already in the gelatin cover of the sensitive silver core before they arrived at the disintegration of this substance.

It was the gelatin that lay at the bottom of my failures to photograph extreme ultra-violet.

This important discovery led him to the preparation of a new plate, which was better suited for photography of all rays below wave length 226 than the gelatin plate previously used.

The new plate acts entirely differently toward the light rays from the gelatin plate; little sensitve to all rays of the visible spectrum and the less deflected ultra-violet rays, it increases in its sensitiveness from 226 to about 186. At 186 the plate seems to have the greatest susceptibility for light impressions, at least from electric light sources, as others do not create so strongly deflected rays.

Further toward the deflectible side the sensitiveness decreases somewhat; yet wave length 182, marking the limit for the sensitivness of the gelatin plate, has no intercepting influence; strong and clear in outline even beyond 182 it will render the spectrum efficiency-strip.

If the spectrum apparatus works with a prism then it appears as if the light masses emerging from the fountain, otherwise withheld from the eye in eternal night, would never end.

With every additional region introduced for photography are things to attain the limit of smallest light rays.

But it seems that the smallest wave to be photographically fixed flees the faster into the extreme ultra-violet, the closer the chain in the shape of the sensitive plate approaches. Schuman's new plate shows already beyond 185 a spectrum strip, that distances the whole efficiency of the bromid of silver gelatin more than three times in length, but the last of my exposures allows me to hope that beyond the edge of this plate there is yet light of photographic efficiency.

The photography of the neighboring region is meanwhile obstructed by obstacles that, if at all, can be removed not without difficulties.

Photography in a vacuum presents some difficulties and requires far greater care than under ordinary conditions. Even under the most favorable conditions the photographic effect of these extremely refrangible radiations is relatively so very weak that on many plates prepared according to some of the best methods it is found difficult to establish the existence of the vibrations of the shortest wave lengths. Mr. Schuman found this fact also in his own experiments, and cites it as such. This is a fact and bears me out, since I have found that the light emitted from a vacuum tube is too dim when compared with electric sparks or electric arc. There is not enough quantity of light present to act upon the photographic plate as when

a spark or the arc is made use of. Nevertheless, this fact remains that all spectrograms of the ultra-violet light show even on ordinary plates that the penetrative quality of these rays from a vacuum tube is shown in full detail. I am certain from my observations and those of Mr. Shuman that if special arrangements were made the vacuum spectrum would as far exceed the ultra-violet spectrum as that exceeds the spectrum from the electric arc spark.

His preliminary experiments in this direction are nearly finished, and are very promising. Under these conditions, he has named the length of the smallest light wave from his exposures only as an estimate and with reserve; it may not exceed 100, and might even be considerably shorter. To the wave length 100 corresponds an extremely high number of vibrations of the ether. While the most deflectible sun rays vibrate little more than 1,000 trillion times per second, a ray of the wave length 100 will vibrate 3,000 trillion times.

Hitherto the spectroscopist has not had to figure with vibrations of such frequency; and yet it may be possible to follow the effects of the light ether close to wave length zero when the finite will be hardly able to express the immense number of vibrations.

A New Radiation.—Sanford writes in *Phys. Rev.* for December a long paper on an undescribed form of radiation. When the terminals of the secondary winding of an induction coil are connected to the plates of an air condenser, the condenser plate connected to the kathode gives off a peculiar form of radiation into the condenser field whenever the current is interrupted in the primary coil. If a spark is allowed to pass between the discharging knobs of the secondary, the radiation is given off from both condenser plates; but when no discharge occurs it is given off only from the kathode plate. This radiation appears to be of the same nature as the ultra-violet radiation from a luminous body, and may be reflected, refracted and polarized like ordinary light. When it falls upon bodies placed in the condenser field, these bodies become sources of a secondary radiation very similar in its properties to the primary radiation by which it is produced. This secondary radiation may, in the case of metals at least, be given off both from the side of the body upon which the primary radiation from the kathode falls and from the side facing the anode. It may even be given off into an insulated hollow conductor placed in the condenser field. In addition to this secondary radiation, the metals may reflect the original primary radiation. The experiments made by the author are described at length. To explain them he says that had the experiments been carried on in the field of a condenser from which the air had been exhausted, the ordinary kathode radiation would have passed across from the kathode plate to the anode. Since this kathode radiation is believed to consist of negatively-charged electrons driven off from the kathode, it seems probable that the same electrons will be sent off when the space between the condenser plates is filled with air. In the latter case they are stopped by colliding with air molecules, while in the former case they are stopped only by the anode or the walls of the containing vessel. These electrons when striking against the walls of the tube or against metal plate contained in the tube, give rise to the Roentgen radiation, and it seems probable that their collisions with the gas molecules in the condenser give rise to the radiation described by the author.—*Elec. World.*

Polarization in Roentgen Rays.

Some experiments have been made by Mr. Charles G. Barkla, in order to determine whether any polarization takes place due to Roentgen rays. As explained by Dr. J. J. Thomson, Roentgen rays consist of a succession of electromagnetic pulses in the ether. Therefore, each ion in the medium has its motion accelerated by the intense electric fields in these pulses, and consequently is the origin of a secondary radiation which is most intense in the direction perpendicular to that of the acceleration of the ion. If, then, a secondary beam be studied, the direction of propagation of which is perpendicular to that of the primary, it will, according to this theory, be plane polarized, the direction of electric intensity being parallel to the pulse front of the primary beam. It occurred to the author that as Roentgen radiation is produced in a bulb by a directed stream of electrons, there is probably at the antikathode a greater acceleration along the line of propagation of the kathode rays than in a direction at right angles. Consequently, if a beam of x-rays, proceeding in a direction perpendicular to that of the kathode stream, be studied, it should show a greater electric intensity parallel to the beam than in a direction at right angles. He used a beam of this sort as the primary radiation, and studied, by means of an electroscope, the intensity of secondary radiation proceeding from a sheet of paper in a direction perpendicular to that of propagation of a primary beam. By turning the bulb around the axis of the primary beam studied, the intensity of this beam was not altered, but the intensity of the secondary beam was found to reach a maximum when the direction of the kathode stream was perpendicular to that of propagation of the secondary beam, and a minimum when these two were in parallel. Several methods were tried, all of them giving similar results. The variation of intensity of the secondary beam amounted to about 15 per cent of its value, but this does not represent the true difference, as beams of considerable cross-section were studied. Consequently, secondary rays making a considerable angle with the normal to the direction of propagation of the primary rays were admitted into the electroscope.—*Electrical Review.*

Properties of Fluorescing Substances.—If strongly fluorescing substances, such as akredin, eosin and quinine, are allowed to act upon lower organisms in the presence of light, they will manifest strong bactericidal properties. Similarly the action of ferments is inhibited and toxins, such as ricin, will lose their power to agglutinate red blood corpuscles. These phenomena are not observed in the dark or if the rays causing fluorescence are cut off. In order to determine any possible therapeutical value, H. v. Tappeiner and D. Jesionek (*Münch. med. Woch.*, November 24, 1903) applied eosin to three cases of epithelioma of the face and then exposed the ulcerations to the sunlight. In two, cicatrization was complete in fifty to sixty days, and in the third, an extremely malignant growth, which had destroyed almost the entire nose, healthy granulations were beginning to form. Equally good results were obtained in lupus, scrofuloderma and syphilitic affections of skin and mucous membranes, such as broad condylomata. The action is most intense where the diseased tissue lies exposed, but sometimes the action of light will set up an erythema which hastens ulceration and thus allows the eosin to act directly. Experiments on subcutaneous and oral use of eosin are in progress.—*Medical News.*

The N-Rays and Radio-Activity.

It would be hard to mention an improtant scientific discovery which has attracted less public attention than Blondlot's beautiful researches on the rays which he has thus named. The daily press, which is usually generous to striking discoveries, seems hardly to have learned that N-rays exist. And yet no work within a decade gives richer promise of important results. M. Blondlot's latest discovery is that radiants which give out N-rays can communicate a similar variety of radioactivity to some neutral bodies upon which the N-rays fall. The phenomenon was discovered while concentrating the rays by a quartz lens upon a phosphorescent screen, when it was found that the N-radiation persisted with the lens as a source after the original source was removed. Following up this clew, it turned out that various other substances became temporarily active after exposure to N-radiation. A sheet of lead, for example, became active on both faces after exposure to the rays, producing an effect that might easily have been mistaken for penetration of the lead by a less experienced observer. In short, a set of phenomena closely similar to so-called induced radioactivity are produced by these extraordinary N-rays, which have so commonplace an origin as a Welsbach burner, and are reflected and refracted like any other kind of radiant energy. The N-rays appear to form a connecting link between the ordinary phenomena of light and the singular effects of radioactivity which have set the scientific world agog within the last year or two. No explanation of the latter can now be regarded as complete unless it takes full account of the former and their relation to ordinary radiation. A linkage of this sort is invaluable in preparing for generalization the great mass of experimental data that has been accumulated. The complete emission spectrum of a radiating substance has thus far never been determined, and until this can be done the phenomena which belong to the radiation can not fully be determined. The study of the N-rays has opened a new field of investigation which seems likely to yield some very important theoretical results.—*Electrical World and Eng.*

More Properties of N-Rays.

It has been found by M. R. Blondlot that there are several kinds of N-rays. Those first discovered increased the luminosity of a feebly luminous surface. He has now found a type which has the opposite effect. The new rays he has designated as N′-rays. He has measured the index of refraction and the wave-length of part of the spectrum of these rays. M. Blondlot has also found that a probable explanation of the failure of other physicists to repeat his observations lies in the fact that the emission of light is effected by the N-rays, in the sense of being concentrated upon a normal, rather than upon a tangent plane. Thus, if an observer is watching the surface perpendicularly, it brightens up, while if he looks along it, it appears to become duller. This condition is just reversed by the N-rays. The effect of the magnetic field, as observed by Gutton, appears to be the same.

As the wave-length of N-rays is extremely small, it might be expected that the rotation of polarized light produced by a magnetic field would be very pronounced. This has been investigated by M. H. Bagard, who used a prism of aluminum to separate the various beams of N-rays and polarized them by means of a glass plate held at a suitable angle. The source of the rays was a Nernst lamp. The polarized rays were trans-

mitted either thru aluminum or thru carbon bisulphide placed in a magnetic field. Even with a weak field, the rotation observed is very large, amounting to a maximum of 45 degrees in the case of aluminum, and 54 degrees in the case of carbon bisulphide. Repeating the same experiments with ordinary light, rotations of only four minutes were obtained.—*Electrical Rev.*

Rod Ausculation.

In the *Post Graduate* for February Dr. J. H. Tyndale describes a percussion rod invented by Dr. Ed. Reichmann, of Berlin. This little ivory rod is seven centimeters in length and is roughened so as to intensify the friction sounds when the fingers are passed over its surface. When the limits of an internal organ such as the heart is to be defined the stethoscope is applied to the organ, and near it the end of the rod is pressed down firmly upon the skin. The end of the finger is then rubbed downward upon the rod with moderate force. As the rod is moved across the borders of an organ the friction sounds are dulled. Using this rod a sharp outline of the individual lobes of the lung may be obtained without difficulty.

Differences in the density of organs and tissues can not be determined by this method.

Sterilization of Water by Ozone.

Dr. Barbier (*L'Electricien*, December 12, 1904) advises the use of ozone, which is obtained by means of electrical discharges between plates of glass one or two millimeters apart. The air is first dried, then passed up thru a tower, in which it meets the water sprayed down from above. One cubic meter of air sterilizes six cubic meters of water.

Testing Oysters for Pearls.

A new use for the Roentgen rays is announced from Paris. M. Dubois has just read a paper before the Academy of Sciences, which shows that it is possible, by means of the Roentgen rays, to examine the living oyster, without in any way injuring it, and to ascertain whether or not it contains a pearl. If it contains only a tiny pearl the oyster is returned, and is allowed to live until the disease has sufficiently advanced.—*Electrical World and Engineering.*

Orthopedics and Radiography.

An accurate diagnosis in a large percentage of orthopedic cases without x-rays is impossible, says Byron C. Leavitt, of Denver, in the *Denver Medical Times*, October, 1903. The condition of the bones is all important. In the region of the hip radiography is especially valuable, and without an exact diagnosis the treatment is often mere guess work.

He illustrates these statements with a brief history of a number of cases in which the patient received no advantage from treatment until an accurate diagnosis had been made by the x-rays, after which proper treatment being instituted prompt recovery followed.

Radium in Blindness.

Dr. S. G. Tracy, in the *Medical Brief* for January, quotes Dr. Lunder, of Berlin, who found a distinct improvement of vision of two boys almost totally blind. He also reports some experience upon a case of optic atrophy of four years' standing. The radium tube was held half an inch from the eye for three minutes. Luminosity appeared and remained for half an hour. The treatment was repeated three times a week, and during the four weeks he has been under treatment improvement has been very marked.

EDITORIAL

At the regular meeting of the Physicians' Club, of Chicago, held February 16, 1904, and reported in the *Illinois Medical Journal* for April, Mr. Clarence Darrow is quoted as follows (page 855) during the discussion on "graft":

"Another illustration came to me personally last week, and I had these two things in my mind when I spoke of physicians posing for public offices, which I do not believe in any more than the last gentleman who spoke. A man by the name of Fuchs, who takes x-ray pictures or skiagraphs, who is among the best x-ray men in the city of Chicago, and who is patronized by a large number of the best surgeons in the city of Chicago, brought to my office the other day a letter which was addressed to him by one of the officials of the State Board, saying he was going to be prosecuted for taking these pictures or skiagraphs because the law did not allow anybody but a licensed physician to take these skiagraphs. A number of surgeons in Chicago had spoken to me about this, because they are very much interested, and have asked me to do what I could in the man's defense. Of course I told them I would. But it appeared to me then, as it appears to me now, that this is purely a case where political doctors, not the best doctors in Chicago, who are put in office and are making money out of the office attacking this man as they attack dozens of others in your profession, for the graft that there is in it. These were the only two matters I had in mind."

There is no doubt that the use of x-rays for therapeutic purposes is medical practice. There is no doubt also that it is impossible to use the x-rays for diagnosis without also producing other effects. Before the therapeutic effects of the Roentgen rays were thoroly understood some photographers found this a paying branch of their business. Since it has become clear that such work by unlicensed practicians is a violation of the medical law of this State, it is the duty of all good citizens to see that the laws are properly enforced. If it happens that there is one man whose experience and training are such that he can, with safety to the public, practice this or any other department of medicine, let such a man pass the required examination for a license; and if he refuses or is unable to do so let him have the same privileges as other violators, namely, either to cease his unlawful practice or to receive the penalty due. It is a subversion of justice to let one man escape for violations of law for which other men are punished. It is a disgrace for any man in a public position to advocate or condone such procedures.

The State Board of Health of Illinois has taken the stand that the medical law must be enforced impartially. They have courteously extended to known violators of the law a notice to cease violations, in order that they may not meet with punishment. In case such a notice is disregarded every physician and surgeon should loyally stand by the Board in its efforts to enforce the law. If the law itself is wrong let it be amended or repealed, but while it stands let there be no respect of persons.

We are credibly informed that some "ethical" men, in good standing in the Chicago Medical Society, have so far for-

gotten what is due to themselves, the Society and the profession, as to urge upon the State Board of Health immunity from prosecution for certain favored lawbreakers.

When members of our own profession attempt thus to throw open the door to quackery, electrotherapeutists are justly incensed. Surgeons would properly resent an attempt to allow amputations to be performed by one whose only claim for recognition was manual skill in the work. Electrical workers in the profession resent equally an attempt to allow x-ray practice to be carried on by men who are not physicians, but who have skill in the mechanical art of photography. X-ray diagnosis is a part of medical practice, and its use by unlicensed men must be stopped.

The Tri-State Medical Society of Iowa, Illinois and Missouri will meet in St. Louis, June 15th, 16th and 17th. An interesting program is being prepared, and some of the most distinguished physicians and surgeons of the country will attend the meeting. The president is Dr. W. B. La Force, Ottumwa, Iowa, and Dr. Louis E. Schmidt, 1003 Schiller building, Chicago, is the secretary. Dr. James Moores Ball, 3509 Franklin avenue, St. Louis, is chairman of the committee on arrangements.

W. B. La Force, President.

Operations Under X-Ray.

Dear Doctor—Recently I had two cases in which the x-ray did signal service. It might be of interest to the readers of your journal to have them reported therein.

The first was that of a little girl four years old, who swallowed a 25-cent piece twenty-four hours before being brought to my office. The x-ray was applied and the coin was clearly discernible lying in the esophagus in front of the first dorsal vertebra. Chloroform was given and a long curved forceps introduced into the throat. The forceps would not reach within a half inch of the coin altho pressed in with considerable force. The anesthetic was diminished when the pressure of the forceps caused the child to gag, bringing the coin up within reach, when it was easily grasped and removed.

The second case was that of a boy twelve years old, who was shot in the back of the neck with a 22-caliber rifle. The ball entered the neck two inches behind and one inch below the lobe of the right ear, passing under the skull and lodging in the upper part of the mouth at the junction of hard palate and alveolar process. The bullet was located by the aid of x-rays and removed thru the mouth. No damage was done beyond a slight fracture of the hard palate and the boy is making good recovery.

Yours fraternally,

Robert Telford, M. D.,
Vancouver, B. C.

American Association for the Advancement of Science.

The annual meetings of the American Association for the Advancement of Science and of the American Physical Society will be held in St. Louis, Mo., in "Convocation Week," from December 28, 1903, to January 2, 1904.

Finsen Light and Roentgen Ray for Uterine Carcinoma.

Dr. George G. Hopkins, *Brooklyn Medical Journal*, December, 1903, considers that by these two methods combined carcinoma of the uterus and adnexa can be completely cured if taken before the disease has extended beyond this region.

He discusses the therapeutic value of various chemicals and describes his apparatus for the local use of Finsen light and x-rays.

International Electrical Congress.

The following papers are promised for Section A—the section on "Theory"—of the Congress, of which Prof. E. L. Nichols is chairman and Prof. H. T. Barnes secretary:

FOREIGN.

Prof. Dr. Paul Drude, "Metallic Conduction"; Prof. Dr. W. Jaeger, "Electrical Standards"; Sir Oliver Lodge, F. R. S., "Ions"; Prof. H. Nagaoka, "Magneto-Striction"; Prof. Dr. J. J. Thomson, F. R. S., subject to be announced; Prof. J. S. Townsend, F. R. S., "The Theory of Ionization by Collision"; Mons. J. Violle, "Secondary Standards of Light"; Mr. C. T. R. Wilson, F. R. S., "Condensation Neuclei"; Prof. P. Zeemann, "Magneto-Optics."

AMERICAN.

Prof. H. T. Barnes, "The Mechanical Equivalent of Heat as Measured by Electrical Means"; Dr. Carl Barus, "Atmospheric Neuclei"; Dr. Louis A. Bauer, "The State of Our Knowledge Regarding the Earth's Magnetism"; Prof. D. B. Brace, "Magneto-Optics"; Prof. H. S. Carhart and G. W. Patterson Jr., Ph. D., "The Absolute Value of the Electromotive Force of the Clark and Weston Cells"; Prof. C. D. Child, "The Electric Arc"; Dr. K. E. Guthe, "Coherer Action"; Prof. E. P. Lewis, "Electrical Discharges in Gases"; Prof. L. T. More, "Electro-Striction"; Prof. E. Fox Nichols, "The Unobtained Wave Lengths Between the Longest Thermal and the Shortest Electric Waves Yet Measured"; Prof. E. L. Nichols, "Standards of Light"; Harold Pender, Ph. D., "Magnetic Effect of Moving Charges"; Dr. M. I. Pupin, "Electrical Theory"; Dr. Edward B. Rosa, "Alternating-Current Measurements"; Prof. E. Rutherford, "Radioactive Change"; Prof. J. C. McLellan, "Radioactivity of the Atmosphere"; Prof. J. Trowbridge, "Electrical Discharge in Gases"; Prof. A. G. Webster, "Electrical Theory."

A meeting of the Congress Committee on Organization is scheduled for April 23 at 1:30 p. m., in New York. All Congress officers have been invited to attend. The meeting will be at 95 Liberty street, New York, at the offices of the American Institute of Electrical Engineers.

Acceptances of membership in the Congress number over 1,300, up to the present time, and 150 papers have been promised in all. The following societies have all promised to hold conventions at St. Louis during the Congress week, and to hold conventions with one or more sections of the Congress:

The American Institute of Electrical Engineers, American Physical Society, American Electro-Chemical Society, American Electro-Therapeutic Association, International Association of Municipal Electricians. The British Institution of Electrical Engineers has also arranged to coöperate under some plan, the details of which have not yet been determined.

The following bodies have promised to coöperate by sending delegates: The Société Internationale des Electriciens, National Electric Light Association, Association of Edison Illuminating Companies. Coöperation is expected from various other societies.—*El. World and Eng.*

A Ukase Against the Wireless.

Last week we gave some very interesting details about the enterprise of the London *Times* in equipping a small steamship and land station at Wei-Hai-Wei with the De Forest wireless telegraph system, by means of which that dashing correspondent, Colonel James, has been sending brilliant and unique dispatches from around Port Arthur to that journal and the New York *Times*. Immediately following upon that article came the news that at Washington, on April 15, the cabinet discussed a communication received by the state department from Count Cassini, the Russian ambassador, which apparently means that the Russians intend, if they capture any press correspondent using wireless telegraphy either near land or on the high sea, to treat him as a spy and hang him. It is understood that similar communications were made to the foreign office of other nations. The note received by Secretary Hay is as follows:

"I am charged by my government, in order to avoid all possible misunderstanding, to communicate to your excellency that the lieutenant of his imperial majesty in the far East has just made the following declaration:

"'In a case in which neutral steamers having on board correspondents who might communicate war news to the enemy by means of perfected apparatus not being yet foreseen by existing conventions would be arrested near the coast of Kwan-Tung or in the zone of operations of the Russian fleet the correspondents will be looked upon as spies and the steamers furnished with wireless telegraphy seized as prizes of war.'"

This action has created a sensation and is now under vigorous discussion on both sides of the Atlantic. According to advices from London, the communication from the Russian government to the British foreign office intimates that Russia does not contemplate any immediate action in the matter.—*El. World and Eng.*

Suggestion.

Let us turn to some of the legitimate uses of suggestion in therapeutics. The first of these is in self-confidence begotten of thoro knowledge on the part of the physician. There is no royal road to learning. Proficiency in therapeutics is paid for by long years of hard study and close observation. The physician's ability to make an accurate diagnosis is the first requisite for securing both his own and the patient's confidence in his ability, correct prognosis the second, and when there is added to these a thoro knowledge of the physiologic action of his therapeutic agents, then the physician can prescribe his remedies with confidence, adding to their physiologic effects the expectancy of the patient's mind. No one is justified in prescribing a placebo; that is a confession of ignorance. The physician should know what to expect from his remedies, and this expectation he should place before the patient with all the positiveness he can command, not hedged even by the doubts that may be in his own mind.

But it is not necessary nor desirable to deliver a lecture on pathology with each prescription as is the custom of some. The patient, especially if he is neurotic, is already too much engrossed with his symptoms, and it should be an object to turn his attention away from himself. Rather shame him for sitting like the navel gazers studying his internal sensations. Is he a hypochondriac as most of these patients are, tell him of such instances as Beethoven whose very soul was music, yet long after he could not hear a note of the loudest instrument he went on composing

music for others to enjoy; of Henry Fawcett who, after he became blind, went through Cambridge University and became a professor, then into public life, and was England's most capable Postmaster General; of Laura Bridgman, both blind and deaf, yet who found life a joy and blessing; of William of Orange whom Macaulay calls an asthmatic skeleton, or Luxembourg, his opponent at the battle of Lamden, who was a hunchback dwarf. Preach to him the gospel of work with Thomas Carlyle, who exclaims: "Produce! Produce! Were it but the infinitesimal fraction of a product, produce it in God's name. 'Tis the utmost thou hast in thee, out with it then. Up! Up! Whatsoever thine hand findeth to do, do it with thy whole might!"

The doctor must himself set the example. He must be courageous, enthusiastic, hopeful and masterful. An ill doctor cures no patients. The pessimistic doctor can not in good faith bid his patient go forth into God's sunshine and green earth and be healed.

But after all "The dog returns to his vomit and the sow to her wallowing in the mire," so these patients *enjoy* poor health. The nearest some of them ever come to being happy is when, like the Ancient Mariner, with the glittering eye, they find a sympathetic listener to their tale of woe; indeed, sympathy and condolence come to be their meat and drink. Like the derelicts of the ocean they would not be worth the dynamite needed to blow them out of the water were it not for the menace they are to the other craft.

And yet what may be accomplished in some of these cases when suggestion is made through the right channel is shown by a case that came under my observation. A fellow-boarder, a woman, was a typical valetudinarian. She had corneal opacities, and iridectomies had been made to secure colobomata opposite the best parts of the cornea, but even with lenses of complicated formulas she could not see to read or to do fancy work; her only occupation was introspection. Each meal-time brought some new complaint or a variation of the old ones. She became a convert to Christian Science and as at the wave of Ariel's wand her character changed. She ceased to speak of her infirmities, laid aside her spectacles, and whether her opacities cleared up or not I can not say, but such a result has been known to follow. She left the boarding-house and became a model housekeeper. The right channel in this case, as in many others like it, was the religious susceptibility, a broad one that has as yet been but little exploited. But that is work for the theologians to do. Perhaps some day they will begin to preach the duty of happiness in this world as in the next one.—*Dr. Grube, in Cleveland Med. Jour.*

Hydrotherapy, Electricity and Massage in in Diseases of Children.

Dr. Herman B. Sheffield, in the *Post Graduate* for February, says it is a good rule never to give children a drug when any other remedial agent may be employed. In using water for children, extremes of heat and cold should be avoided. He describes the various modes of its application, both externally and internally, commending especially high enemas of saline solutions for uremia, typhoid fever, scarlet fever, smallpox, measles, diphtheria, eclampsia, anemia, hemorrhage and shock. We emphasize his recommendations.

A nine-tenths of one per cent salt solution at a temperature of 100° F. is injected slowly thru a colon tube for fifteen or twenty minutes.

In discussing electricity, Dr. Sheffield has apparently fallen behind the age, as he knows only "galvanic, faradic and static." His rules for the application of electricity indicate also his unfamiliarity with the fundamental principles of electro-therapeutics.

Cancer of the Cervix.

Dr. W. B. Chase, *Brooklyn Medical Journal*, December, 1903, recommends the thermo-cautery for this condition as a palliative measure which is sometimes followed by cure. Salutary effects also follow the use of the Roentgen rays, which cause rapid disintegration of malignant structures with healthy resultant granulations.

Hydropathic Treatment of Acute Sepsis.

J. Wernitz (*Samml. Klin. Vortr.*, N. F., No. 352) advises the injection into the rectum of large quantities of a warm one per cent salt solution until the contents are thoroly cleaned out. A high rectal tube is used. The colon is kept full of the salt solution under low pressure for an hour afterward. The results are increased secretion of urine, decrease of thirst, free perspiration and reduction of temperature.

X-Ray for Epithelioma.

Dr. D. W. Montgomery, in a paper read before the San Francisco County Medical Society, described his work with x-rays. Exposures were made thru holes in lead sheets, which were supported on a wooden frame. After six to fifteen exposures, given for ten minutes on alternate days, a visible reaction was obtained. The tube was bret sometimes as close as one and a half inches in order to get a strong reaction. Then a vacation was given, and, if necessary, a second series of exposures followed. He advises the x-ray for nearly all skin cancers.

Results in Roentgen Diagnosis.

The advance made in diagnosis has raised the standard by which the surgeon's methods of diagnosis and treatment should be judged. The patient who is suffering from a fracture should not be compelled to submit to pain and further injury from diagnostic procedures. He can not demand results out of proportion to the injury he has sustained, but he can demand as "reasonable care" that the Roentgen method be employed.

The value of these examinations is not wholly the patient's. They guard the interests of the practitioner. They show how serious the osseous injury has been, that a reasonable apposition has been made and that the fixation apparatus is effective. This is valuable evidence. The established value of this method makes it necessary to employ it in every case, but especially in any case where a reasonable doubt exists. If it has not been employed, or its use suggested and aid refused by the patient, it can not be said that all reasonable care and means have been used to the best of the surgeon's knowledge and ability.

The increased efficiency of treatment resulting from this more accurate and early method of diagnosis has a widespread effect. This effect has been particularly noticeable in the diagnosis of calculous conditions of the kidneys and ureters. In these conditions the symptoms are often vague and misleading, often out of all proportion to the seriousness of the case. A small quiescent calculus may form the gravest menace. Its impaction may result in complete anuria and the destruction of the kidney. The symptomatology does not differ from less serious conditions. The symptoms may all subside and yet an anuria be present. An undetected calculus is always dangerous. The presence or absence of calculi should be determined

after a suspicious attack of renal or ureteral colic. This knowledge gives the exact position of the calculus if present, and forms in conjunction with other symptoms, an accurate basis for treatment. If the calculus is too large to be passed it can be removed at once, and the kidney saved from further injury. If its size shows that it can pass, and there are no threatening symptoms, a course of conservative expectant treatment can be followed. Such a course is only reasonable when based upon such exact knowledge.

The accuracy of this method of diagnosis has been shown in a series of three hundred and five cases that have been referred for examination. Calculi have been found in eighty-nine cases, while sixty per cent of these calculi have been found in the ureter. The negative diagnosis has proved more accurate than the positive. Errors have been made in nine cases or less than 3 per cent. In only one of the forty-five cases of negative diagnosis that were subsequently operated on was a calculus found. In two others small calculi were afterward passed. This method has been shown to possess the following advantages:

It is free from all the dangers that accompany exploratory operations and catheterizations. It is most accurate and comprehensive without occasioning pain, injury or even inconvenience to the patient. The exact number and situation of all calculi are determined so accurately that no calculi are left behind and the operation is certain to be complete. The danger of operating upon the wrong kidney is entirely avoided, and the field of operation is limited to the exact position of the calculus, thus decreasing the operative trauma and facilitating rapid recovery.

The accuracy that has been demonstrated in the negative diagnosis makes it unnecessary and unreasonable to open the kidney in the search for stone during nephrorrhaphies or exploratory operations. The diagnosis can be made early when the least suspicion points to the presence of a calculus. The dangers from small quiescent calculi are thus avoided and the basis formed for reasonable treatment. This method is not infallible, as much depends on the accuracy of its employment and interpretation. All other methods should be employed in connection with it, but no diagnosis can, however, be considered complete without it.—*Charles Lester Leonard in Brooklyn Med. Jour. for Jan.*